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Office of Space Science

**STRUCTURE AND EVOLUTION OF THE UNIVERSE
SUBCOMMITTEE**

**OF THE
SPACE SCIENCE ADVISORY COMMITTEE**

August 8-9, 2002

**NASA Headquarters
Washington, DC**

MEETING REPORT

Paul Hertz
Executive Secretary

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Chair

STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

August 8-9, 2002
NASA Headquarters
Washington, DC

MEETING MINUTES
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STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

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*Thursday, August 8*Welcome/Introduction

Dr. Edward “Rocky” Kolb, Chair of the Structure and Evolution of the Universe Subcommittee (SEUS), welcomed the Subcommittee members and attendees to the meeting. After introduction of meeting participants, Dr. Paul Hertz, Executive Secretary of the SEUS, made logistics announcements and briefly reviewed the meeting rules under the Federal Advisory Committee Act (FACA).

SEU Theme Update

Dr. Hertz provided an update on SEU events since the last meeting in April. Chandra’s cycle 4 peer review was completed. Science operations will be contracted to the Chandra X-ray Center (CXC). The Space Telescope Science Institute (STScI)-type of operation will be the model for this phase. NASA is completing planning for the Chandra extended mission. The Cosmic Microwave Background (CMB) Data Center at GSFC has been approved. It will be collocated with the Microwave Anisotropy Probe (MAP) project and will curate Cosmic Background Explorer (COBE) and Submillimeter Wave Astronomy Satellite (SWAS) data. The Astronomical Data Center (ADC) activities were reviewed extensively. A decision has been made to reduce the ADC, and GSFC will provide plans on how to do that. The Astronomy and Physics (A&P) Division is restructuring the Research and Analysis (R&A) program to have an integrated astronomy and physics solicitation. There will be four groupings of solicitations in the Research Opportunities in Space Science (ROSS)-03 solicitation: Space Astronomy and Physics R&A; Astrophysical Data and Theory, Guest Investigator (GI) Programs, and some programs from other Divisions (planet searching and astrobiology R&A plus instrument development). Dr. Hertz described the elements within each of these groupings. In April, there was an initial selection for the Medium-class Explorer (MIDEX) 01 Announcement of Opportunity (AO). Five proposals were selected. Dr. Hertz described the recently selected MIDEX missions: the Astrobiology Explorer (ABE); the Next Generation Sky Survey (NGSS); the Extreme Universe Space Observatory (EUSO), which is a Mission of Opportunity (MoO) with the European Space Agency (ESA); the Time History of Events and Macroscale Interactions during Substorms (THEMIS); and the Advanced Spectroscopic and Coronagraphic Explorer (ASCE). NASA also downselected two Small Explorer (SMEX) missions for flight and is moving forward with the next SMEX AO. The draft AO should be out next week and the final AO should be released in February 2003. The two SMEX missions selected were: Aeronomy of Ice in the Mesosphere (AIM); and Spectroscopy and Photometry of Intergalactic Medium (IGM) Diffuse Radiation (SPIDR). “Beyond Einstein” was presented as NASA’s response to the Turner Committee Report. NASA has become involved in a multi-agency discussion group that includes the Department of Energy (DOE), the National Science Foundation (NSF), and the Office of Science and Technology Policy (OSTP). The science director of OSTP, Dr. Marburger, has been briefed on the program. In response to a question, Dr. Hertz noted that the next MIDEX is planned for early to mid-2004. From the four MIDEX selected this year, a downselect of two is expected.

Astronomy and Physics Report

Dr. Anne Kinney thanked the SEUS members for their participation on the Subcommittee. In response to a comment, Dr. Hertz asked members to convey to him or Dr. Kinney names of potential candidates to serve on the Subcommittee. About one-third of the current members will be rotating off the Subcommittee next year.

Dr. Kinney reviewed the missions in development. She noted that there would be limited discussion on the Next Generation Space Telescope (NGST) because it is currently in the competitive process. Everything is going extremely well on the Space Infrared Telescope Facility (SIRTF)—successful completion of thermal vacuum testing and the mission operations system end-to-end test—and it is on track for a January 2003 launch. Dr. Kinney briefly discussed the science that will be done on SIRTF. At the end of last week,

Gravity Probe (GP)-B started having problems with the forward equipment enclosure (a leak in the dewar due to an epoxy seal). There will be at least a three-week delay and schedule reserve is being depleted. This remains a prime concern for the Division. The project scientist presented a more detailed update on GP-B on the following day.

Dr. Kinney showed the “fever charts” for all of the missions in the Division. In general, all of the operating missions are “green.” There are some problems with a few of the smaller SEU missions, but the problems are being worked and none are considered to be “show-stoppers.” Most of the Origins missions are green. Keck is red due to pending litigation with the Office of Hawaiian Affairs. Dr. Hertz noted that selections on the NGST science instruments team have been made since the last meeting. In response to a question, Dr. Kinney commented that the Space Interferometry Mission (SIM) telescope was redesigned last year with a very strict cap and prescribed reserves. The telescope was simplified and SIM now has a very viable design within budget. The program was also put on a set of technology milestones, and to date, all of these milestones have been met or exceeded. Some of the SEUS members expressed discomfort with nucleosynthesis being “claimed” by Origins. In response to a question regarding the “lines” between SEU and Origins, Dr. Kinney stated that themes in the Enterprise are intellectual constructions used to help communicate the science. There will always be overlap between the two. Origins can be thought of as emergence of the modern universe (after the big bang). Dr. Kinney commented that it works better to have discrete sets of missions in each roadmap, although a mission can serve more than one theme, e.g., the Single Aperture Far-IR Telescope (SAFIR). Another concern is that there could be some compelling science that falls into a “gap” because it doesn’t naturally fit into the theme constructs. Dr. Kinney noted that the SAFIR issue will not make a major difference for this roadmap. The number one priority in SEU is Beyond Einstein. It was noted that there will be an overlapping Origins Subcommittee (OS)/SEUS meeting in December. It is important for both groups to take up the question of the significance of the science for the theme.

Report from the August Space Science Advisory Committee (SScAC) Meeting

Dr. Kolb reported on the SScAC meeting that was held earlier in the week. He briefly reviewed the NASA advisory structure. There were presentations and discussions on roadmap plans, a report from the Office of Space Science (OSS) Associate Administrator, Dr. Edward Weiler, and a report from the Education/Public Outreach (E/PO) Task Force. There is now a NASA tiger team looking at education, and there will be a new Education Enterprise. One of the concerns was that all education might migrate to this Enterprise. Dr. Kinney noted that there was a meeting with the new Education Associate Administrator on the previous day. OSS education is integrated everywhere and is 1% to 2% of the budget. The Associate Administrator recognized that OSS education is very good, and that OSS education activities per se would not be moved out of the Enterprise. However, there is discussion about moving Dr. Rosendhal and his group to the new organization. The goal is for education in the other Enterprises to be ramped up to be comparable to what is being done in OSS. Several members expressed concern that the OSS activities could be “lost” to the new Enterprise. SEUS felt that space science education should not be separated from the content providers (OSS), and that it is important the OSS E/PO should stay within the OSS organization. Dr. Kolb noted that there is still an opportunity for input to Dr. Knappenberger’s E/PO Task Force. Another issue discussed at the SScAC was Mars Exploration Rovers (MER). There is still concern with the schedule for MER. The SScAC had a report on the Sun-Earth Connection (SEC) and Solar System Exploration (SSE) decadal surveys, as well as a report on the National Research Council (NRC) Origins of Life study. There was still confusion on SScAC about funding lines, programs, etc.

Cost caps for various programs were discussed. The only one relevant to the SEU is the Explorer line. Dr. Kolb asked for Subcommittee discussion on the cost cap issue. It is clear that a larger portion of the cost must be used for launch vehicles. Dr. Hertz noted that in the next SMEX, the cost cap will include additional funds for inflation, increased launch costs, etc. There were several comments from the SEUS members. It was noted that the cost caps focus the science for a certain amount of money, and a cost cap competition can be very positive. However, cost caps need to be carefully assessed to make sure that the best science for the dollar can be obtained. In a cost-capped environment, proposers tend to become risk averse, and sometimes the best ideas are not proposed. In general, the SEUS felt that cost caps are good, but the correct optimization has not been obtained. There should be a way to get better community input on the costing of the Explorer class missions. Dr. Kolb noted that there were two issues that the SScAC

plans to bring to the NAC (after gathering additional information): small launch vehicles and the technology “gap”—technology readiness level (TRL) 2-6. The launch vehicle market is driven commercially, and there is no commercial market for small launch vehicles. OSS does not buy enough small launch vehicles to keep an industrial line going. At issue is the viability of the SMEX program. Any solutions, e.g., a waiver to use foreign launch vehicles, would have to be an Agency action. With respect to technology, the Office of Aerospace Technology (OAT) is responsible for low-TRL activities for the Agency. The issue is support for mid-level TRL. Several SEU members also identified this “gap” as an issue for the SEU theme, and several working groups have identified this as a serious problem.

Committee on Astronomy and Astrophysics (CAA) Report

Dr. Wendy Freedman provided an update on the CAA, which is a joint committee of the Space Studies Board (SSB) and the Board on Physics and Astronomy (BPA) of the National Research Council (NRC). Its unofficial charge is to shepherd the NAS Decadal Surveys. The CCA provides advice to both NASA and NSF and serves as liaison to OMB. With respect to SEU, CCA has been looking at Constellation X (Con-X), the Laser Interferometer Space Antenna (LISA), the Gamma ray Large Area Space Telescope (GLAST), Theory, and the National Virtual Observatory (NVO). She noted that the OS and SEUS chairs have been invited to attend CAA meetings. In response to a question, Dr. Freedman noted that there is a mechanism for mid-course corrections and adjustments between decadal surveys, e.g., NGST came out of an interim study. Dr. Kinney noted that the decadal survey recommended more (and earlier) support for theory. This is a good idea, and A&P has tried to accommodate this recommendation, e.g., theory for NGST in the ROSS-03. There is the fear that if NASA starts supporting the Large-aperture Synoptic Survey Telescope (LSST), NSF would withdraw. NASA is very reluctant to engage with NSF because astronomy cannot afford to have NSF withdraw from ground-based astronomy. Members from the NASA advisory committees will also serve on the NASA/NSF advisory committee.

Ultra-Long Duration Balloon (ULDB) Program

Dr. Steve Smith provided an update on the ULDB program. He discussed the balloon program metrics, the Trans-Iron Galactic Element Recorder (TIGER) flight in Antarctica, what ULDB is, mission management, systems development, current status, and issues. Balloons have been getting considerable attention for planetary exploration. In addition, Boomerang was a major science and media success. In 2001, the balloon program produced 9% of the science for the Agency, according to the *Science News* metric. Dr. Smith showed the balloon missions by science disciplines. This past year, the number of missions was down to about 15. Although the number of flights has decreased, the average flight hours have been going up. TIGER provided excellent return on science and was a very successful flight (31 days, 20 hours). ULDB has been envisioned as a new NASA science mission carrier. It is growing in its possibilities for application. About 120 days is the duration target. ULDB provides low cost, quick response access to space. It is capable of being flown anywhere in the world, but it will be used primarily in the southern hemisphere due to geopolitical factors. About 1000 kg has been targeted for the science payload. Global telecom is achieved through TDRSS High Gain Antenna. The power system is a solar array with NiMH or lithium ion batteries. Altitude is about 33.4 km. The reason for ULDB is stability and duration. Dr. Smith discussed the balloon mission management philosophy. There is a “design to capability” philosophy for SR&T and a “design to requirement” philosophy for Explorers. For the conventional LDB, it would be business-as-usual. For ULDB, there would be an oversight board. For Explorers, there will be a much stronger mission management structure, reporting to the Explorers office. The ULDB-SR&T mission cost is about \$3.7M for a “new hardware” flight. Reflight would be about \$2M per flight. A ULDB Explorer total cost (primary, reflight, and contingency) would be about \$20.5M for two flights.

Dr. Smith discussed some of the technology in ULDB. One of the biggest developments has been in the area of experimental materials. Other technology focus areas include performance modeling, support systems, balloon design and development, and non-linear membrane structural analysis. Dr. Smith discussed the preliminary and full scale flight tests. Two balloons will be launched to demonstrate that ULDB is a viable vehicle. Issues include international and domestic agreement, over-flight safety restrictions in South Africa and South America, and future funding to maintain technical capabilities. Dr. Kolb invited discussion related to how the ULDB program could fulfill the SEU goals. Currently, there is no mechanism to fund payloads. Funding payloads through the SR&T program is not really viable—there is not enough money. Balloons provide an excellent platform for a lot of SEU science, e.g., x-ray and far

ultraviolet. For the next meeting, Dr. Kolb asked Dr. Swordy to prepare a one-page summary of the science that could be done. It was noted that another advantage of the balloon program is the training of future Principal Investigators (PIs) for flight missions. This is invaluable. The SEUS discussed the possibility of ULDB missions as MoO's under Explorer. Dr. Hertz noted that although no balloon proposals have yet been selected, MoO's have done relatively well over the last year of Explorer competitions. Dr. Peterson observed that people are not well aware of the capabilities of ULDB's. Some technologies could perhaps move up the chain through use of ULDB's as a platform for technology demonstration. COSPAR has established a task force to look into the geopolitical limitations. The SEUS recommended that the Division develop a "capability fact-sheet" on ULDB's for a wider dissemination to the community. Another possibility is a competition for ULDB payloads. For the December SEUS meeting, Dr. Kolb asked that the Division give a briefing on what a ULDB would program look like in terms of potential science that could be done, cost, AO's, technology development, impact to other programs, etc.

Report of the Science Archive Working Group (SAWG)

Dr. Joel Bregman reported on the SAWG. At its first meeting, the SAWG discussed the NVO. It is moving along, but more definition is needed. The main advantage of the NVO is that it will give a lot of people useful tools on a wide variety of data. The SAWG felt that the NVO development should continue toward formation of a real proposal. It will be interesting to see the demonstration projects at the AAS meeting. Another topic of discussion was the ADC. Most of the activities regarding tabular data are carried out by the CDS. It was difficult to understand the unique contribution of the ADC. It appeared that the ADC is hardly ingesting any of the tables. At the presentation in April, the SAWG did not see a clear vision and goal for the ADC. In a letter from the Director, there was a somewhat different perspective on what the ADC is doing. They have been developing software tools that will make the ingestion process more automated and standard. The SAWG would like to see the ADC define its role in a way that also considers how it fits into the CDS and the AAS Journal effort. Dr. Bregman posed a question: Should NASA have a role in ingesting tabular data, and where should it be? The SAWG discussed the CMB Data Center and reviewed a very vague proposal. It is not clear what the level of FTE's should be. The SAWG endorsed the National Herschel Science Center, to be located at IPAC. Data is finally coming into the X-ray Multiple Mirror (XMM) data archive. By US standards, the review and execution of proposals is poor, but hopefully will improve. Dr. Kolb indicated that the report of the SAWG would be circulated to the Subcommittee. It appears in Appendix E to this report.

Report on Senior Review

Dr. Jeff Hayes reported on the A&P Mission Operations and Data Analysis (MO&DA) Senior Review. The Review group met in June 2002. MAP received the highest mark, and was approved for extension for 2 years. Funding for XMM was confirmed. The Far Ultraviolet Spectroscopic Explorer (FUSE) was approved through FY04. The Rossi X-ray Timing Explorer (RXTE) was approved through FY04. 2MASS and the High Energy Transient Explorer (HETE)-2 were recommended for termination in FY04. The Submillimeter Wave Astronomy Satellite (SWAS) was recommended for termination after FY03. Dr. Hayes reviewed the Senior Review process. There were several recommendations related to process. In the future, there should be an extended period for Q&A, and presenters should remain available to answer questions after the executive session. The missions should provide clear and consistent explanations of the staffing levels requested in the standard budget submission. The panel was gratified to find explicit recommendations for funding GI's within many of the missions; however, the panel noted a wide range in the average funding per GI among the missions. NASA was encouraged to provide guidelines for establishing levels of GI funding. The panel expressed concern about the relative funding among extended missions and cross-mission programs. Several of the cross-mission programs have over-subscription rates that reach 5 to 1. Such rates may be unhealthy for the future of space astronomy and astrophysics. Dr. Bregman noted that his NRC committee concluded that the over-subscription rate should be 3 to 1.

Roadmap Report and Discussions

Dr. Sterl Phinney, Chair of the Roadmap Team, reported on the status of the SEU roadmap. He reviewed the charter and history of the roadmap. Unlike Origins and other space science Divisions, SEU has no funding line. Missions are approved and funded individually. Cosmic Journeys was an attempt to establish a funding line, but OMB felt that there were too many missions and it was too confusing. Dr. Weiler

advised that a mission line must be represented by tightly-linked missions, rather than a “grab-bag.” White papers on most missions in the previous roadmap were solicited. In addition, the technology group solicited white papers on technology needs. The inputs were integrated into a draft roadmap, which was presented to the SEUS for concept approval. LISA and Con-X are related through black holes, relativity, and fundamental physics. The Team felt that the most saleable and coherent story focuses on black holes and the early universe. These are linked by Einstein. Dr. Phinney briefly reviewed the parts of the roadmap. Part I includes those missions with the highest priority (Beyond Einstein); Part II includes the rest of SEU science (Cycles of Matter and Energy). Beyond Einstein includes the great observatories (Con-X and LISA), an Einstein probe line, and an ultimate vision of the Big Bang Observatory (a LISA follow on) and the Black Hole Imager. Part III of the roadmap contains supporting materials. The bulk of R&A was put there, along with the Explorer Program. E/PO is included in Part I.

The SEUS discussed the draft roadmap. Dr. Kolb noted that concern or comments about specific words should be sent to Dr. Phinney. Beginning Monday, Dr. March will be rewriting the draft to make it “one voice.” Within the focused part of Beyond Einstein, as much of the recommendations of the decadal survey were included as possible, e.g., Con-X and LISA. The only mission that does not have some “history” from an NRC report is a dark energy probe. The Roadmap Team felt that this should be high priority. Dr. Hertz noted that Beyond Einstein cannot be done within the current SEU budget; it will require augmentation. All rewrite actions are due by Monday, at which time it will be given to Dr. March for rewrite. Dr. Hertz reviewed the remainder of the schedule. There will be several opportunities to identify graphics. During October, the roadmap must be approved and sent to print for the planning workshop in November. The SEUS discussed the timing of the “roll out” of the roadmap to the community. The Beyond Einstein objectives are likely to appear on the cover of the roadmap document. The SEUS reviewed the six Research Focus Areas (RFA’s) and did not find that anything was left out of the Beyond Einstein RFA’s. Dr. Phinney noted that the RFA’s will be metrics for SEU. The roadmap also contained six Cycles RFA’s (from the previous two SEU roadmaps).

Dr. Phinney reviewed the new NASA vision (to improve life here, to extend life to there, to find life beyond) and mission (to understand and protect our home planet, to explore the Universe and search for life, and to inspire the next generation of explorers). The Space Science Strategic Plan will be aligned with the NASA vision and mission. The SEUS discussed how the SEU roadmap relates to these three elements. Dr. Hertz suggested that this narrative appear in the roadmap preface. Dr. Phinney reviewed the draft narrative introducing Beyond Einstein. The SEUS felt that it was well written and showed the appropriate relevance to the NASA mission. Minor changes were suggested. Dr. Phinney also presented several variations on the proposed roadmap cover for SEUS review and comment. He recounted the graphic design discussion from the Roadmap Team meeting. There were several good suggestions from the SEUS, and they will be conveyed to the graphic artist for rendering.

Planning for Future Meetings

The next meeting of the SEUS will be December 3-4, 2002, at NASA Headquarters. The first day of the meeting will be an overlap with the OS (about half of the day in joint session). Dr. Hertz solicited items that would be timely for the SEUS to hear about. The Strategic Planning Workshop in November will involve the SScAC, some members from each of the Subcommittees, people from the community, NASA personnel, and people from outside of NASA. The next SScAC meeting will be March 3-5, 2003, at the Jet Propulsion Laboratory (JPL) in Pasadena. The fall 2003 meeting will probably involve concurrent Subcommittee meetings, somewhere outside of Washington. Dr. Kolb suggested that the SEUS meeting after December 2002 be in May 2003, unless something occurs that would require the Subcommittee to meet earlier.

Friday, August 9

Strategic Planning Process and Workshop Plans

Dr. Allen reviewed the 2003 strategic planning process. The roadmap drafts (key contents) are due to NASA Headquarters on September 3. There will be a 60-day “integration” effort by NASA Headquarters, and the material (a viewgraph package) will be briefed by Dr. Weiler at the Mission Bay Strategic Planning

Workshop in early November. The first day of the workshop will be presentation of inputs and the integrated presentation by Dr. Weiler. On the second morning, there will be breakout sessions to revisit the objectives and RFAs and adjust them in a way that is consistent with the roadmap document template. In response to a comment, Dr. Allen noted that at the Agency level, there will be an emphasis on traceability and linearity throughout the system. After the workshop, the Plan will be drafted and will start through the review cycle (SScAC, SSB) at the end of January. It would be advantageous if the Subcommittees could carry forward comments to the SScAC at its March meeting. SScAC comments will be incorporated and the final plan will be written. It will be reviewed by the SScAC in July 2003, after which it will go into production for release in September 2003.

The SEUS discussed the “roll-out” of Beyond Einstein. Dr. Hertz noted that the Division would need to consider the timing with respect to the Space Science Strategic Plan, particularly the November workshop. Dr. Kolb suggested that a powerpoint presentation on the Roadmap be available to the community for briefing purposes. In addition, there should be a one-page “fact sheet.” Planning for the Einstein centennial would be a good idea. Dr. Hertz emphasized that prior to November, that Beyond Einstein should be referred to as the SEU roadmap, not “initiative” or “strategic plan.” Any other comments or ideas should be directed to Dr. Hertz or Dr. Kolb. There will be a SEUS meeting on February 27-28, 2003, at JPL and the primary topic will be reviewing the Strategic Plan.

Report of the Astronomy and Physics Working Group (APWG)

Dr. Flanagan reported on the APWG meeting in April at NASA Headquarters. One of the major issues discussed was the merging of the SR&T and R&A Programs into two large reviews. The APWG felt that flexibility should be maintained for proposers to combine appropriate elements into a single proposal. Any reallocation of funds should be limited to a modest level from year to year. The APWG felt that two large reviews would be very large and difficult to carry out efficiently. In addition, the wide range of technical and scientific specialties would make it difficult to convene a panel with the breadth and interest to capably review the mix of proposals. One possible procedure would be to do the reviews within a few weeks of each other, followed by a meeting between the panel chairs and the discipline scientists to compare the quality of proposals. At the meeting, there was a report on technology development. The APWG liked the idea of open competition and felt that it should be increased to the maximum extent possible. The APWG was pleased to learn of the FY03 augmentation to the balloon program. The ULDB holds great promise for further improving the cost/benefit metric of NASA’s existing balloon technology. Dr. Swordy volunteered to work with Dr. Jones to prepare a “fact sheet” on ULDB’s. Dr. Lester observed that the APWG should be involved in how best to distribute the information to the community. Another hotly debated topic was the NVO. The NVO should not be funded at the expense of R&A. Diversion of resources could be extremely damaging. The APWG felt that bridge funding should be considered where the abrupt termination of a program would lead to the immediate and irrevocable loss of a critical capability. The APWG had a brief discussion on Laboratory Astrophysics issues. There were some concerns in the community that these activities may be losing support because they do not align well with the current structure of the R&A or SR&T programs. The APWG also heard a report on the progress of the response to the report that recommended coordination of NASA and NSF activities. The APWG report is contained in Appendix E.

Initiative Strategies & Funding Lines

Mr. Roy Maizel explained the structure of the budget and the new initiatives. He showed the “appropriations,” in the NASA budget, one of which is Space Science. NASA cannot move money across appropriations without a change in legislation. The FY03 budget represents the first year of funding for a couple of big initiatives in Space Science. Within the Space Science budget are development programs (missions in Phase C/D), mission operations, the technology program, the research program, “investments”, and institutional support. One of the major changes in FY03 is in mission operations. Beginning in 2003, the entire Deep Space Network (DSN) is transferred from the Office of Space Flight (OSF) to OSS. In the technology program, there are three major elements: focused technology programs, the New Millennium Program (NMP), and technology planning. Focused programs are broken out by theme. Funding is kept here prior to implementation of missions, e.g., NGST and SIM for Origins. The main content for SEU is the technology funding for Con-X and LISA. This is where Beyond Einstein would reside. The desire is to have a number comparable to Origins for planned missions. In the research program, there is R&A, Data Analysis (DA), the Suborbital Program, and some Construction of Facilities (CoF) funding. The Agency

budget document, including the detail on the Space Science segment, can be access from the HQ Home Page. With respect to new initiatives, NASA looks at the overall budget and political environment. Currently, the climate does not look very promising for significant new initiatives. There are two ways that initiatives have worked their way into the system: top down (driven by the current Administration or the NASA Administrator) and bottom up (support from the community and NASA). Most of the initiatives are the latter. An example of the former is Origins, which was largely top-down driven, although the Agency was firmly behind it. In recent history, Space Science has done very well in the budget process, and there does not appear to be any major threat to the OSS budget this year.

NASA Exploration Team (NEXT)

Over the last few years, the Enterprises have been supporting a long range, cross-Enterprise planning activity. Dr. Thronson introduced a very high level, broad-brush view of the activity. The primary goal of the NEXT is to identify key technology investments that need to be made in the near term to enable future exploration endeavors. Mr. Gary Martin reviewed the history of the NASA Exploration Team (NEXT). It was chartered in June 1999 as the Decade Planning Team (DPT) to create an integrated strategy for science-driven space exploration. It was a coordinated team (over 100 senior participants) from across the entire Agency. It focused on revolutionary approaches and developed alternative scenarios, architectures, and mission concepts to achieve NASA science goals beyond a 10-year horizon. It developed technology roadmaps, investment priorities, and initiatives. It is an on-going, cross-Enterprise activity with a new formal charter, reporting to the Associate Administrators. The DPT laid out example science questions for exploration of life in the universe. The new NASA policy is that science drivers determine the destinations, not vice versa. NEXT adhered to a process that took as a given the Space Act, the NASA Strategic Plan, and major science goals. The NEXT then undertook mission requirements, systems engineering, and architectural studies and technology trades. As a consequence of the gap analysis, the NEXT determined the technology requirement, priorities, and new initiatives. The NEXT recommended that the technologies for long-term should also have short-term payoff. The Exploration Strategy uses a "stepping stone" approach. As science questions are answered and technologies become available, there is an expansion of greater robotic and human exploration capabilities. We are currently at Earth and low Earth orbit (LEO); the next step is "Earth's neighborhood." Beyond that, the next obvious step would be accessible planetary surfaces, e.g., Mars. NEXT has looked at the priority capabilities that are necessary for each step in progressive space exploration. NEXT is emphasizing the capabilities and technology, not the destinations.

To enable the exploration strategy, five broad areas of capability are needed: space transportation; affordable, abundant power; crew health and safety; optimized robotic and human operations; and space system performance. The first three have first steps via new budget initiatives. Dr. Thronson showed a more specific listing of the top 10 R&D areas for technology investment attention and the status in each area. He noted that there is additional information on the roadmap of each of these areas, beginning in FY02. He emphasized that NEXT is not laying out a path for the future; it is looking at option areas and is proposing technology initiatives to enable the decision makers to make decisions with respect to the future direction of the Agency. One of the option concepts studied by the NEXT was an "outpost" at L1 for a large, lightweight IR/SubMM gossamer telescope. There are a variety of NEXT working groups and teams that have expertise in special areas, e.g., telescopes, contamination, deployment, astronaut assembly, etc. Dr. Thronson reviewed the major activities to date and highlighted proposed future work. One of the most useful products of the activity is tools for conducting far-term, technology system and mission analysis. Later this year, NEXT will try out the tools on a post-Con-X mission concept. This will inform NASA on the priority technology capabilities needed for a whole suite of missions. The goal for future work is to study many types of Space Science missions and provide a comprehensive evaluation of the role humans can play in building/servicing these missions. Because NEXT was recently chartered, it is reorganizing its structure and will be engaging a broader community and external review and input is expected. NEXT is not making up future missions concepts; the members are familiar with the roadmaps and current strategic plans and is taking the goals and mission concepts that are in these documents and that have been explored by the external community. With the new charter, NEXT will become a much more accessible activity than it has been over the past few years. In response to a question, Dr. Thronson indicated that NEXT does not have a formal cost assessment capability; however, it does a relative cost in some of the studies. In most of the studies, complexity has been used as "stand in" for cost. NEXT is looking at investment in capabilities, e.g., nuclear power, that enables a wide range of missions. Dr. Peterson added that for the

benefit of Space Science in the far-term, we have to make use of the human spaceflight program. The SEUS felt that NEXT should be looking at the roadmaps to determine how many missions would utilize a particular technology and what the amortized costs would be.

Roadmap Discussions

The SEUS continued discussion on the RFA's. Dr. Phinney presented a modification to the RFA "observe stars and gas plunging into black holes to map the spacetime near the event horizon." Further changes were suggested. The SEUS discussed merging some of the RFA's for Beyond Einstein, but in the end decided to keep the six RFA's distinct. Some changes were made to the RFA's for Cycles. Dr. Phinney invited members to provide any additional comments on "wordsmithing."

Update on Origins Roadmap

The SEUS discussed Origins Objective 1, "How did today's universe of galaxies, stars, and planets come to be?" and RFA 1 "How did the cosmic web of matter organize into the first stars, black holes, and galaxies?" with Dr. Alan Dressler, Chair of the OS. The SEUS expressed concern over seeing black holes, supernovae, and nucleosynthesis appearing in the OS objectives, RFA's and investigations. The SEUS did not want to leave the impression that this is going to be done in Origins, which is already a funded line. Dr. Dressler agreed to remove the phrase "massive black holes" from RFA 1. He indicated that his roadmap team would be doing a final draft in the next couple of weeks, and could make reference to the cosmic web in SEU and be more explicit about how it pertains to the Origins theme so that there does not appear to be redundancy. Dr. Phinney noted that another SEUS concern was that the choice of words in RFA 1, Investigation 2 ("structure of the early universe") makes it sound like SEU's Beyond Einstein augmentation would not be necessary since it is being done in Origins. Dr. Dressler agreed to reconsider the wording of the investigation so that something other than structure of the early universe is used to describe the investigation. Dr. Phinney shared the SEU objectives and RFA's with Dr. Dressler. He noted that the objectives are the same as those in the previous roadmap. Dr. Dressler observed that the wording in the first two RFA's under Cycles can give the impression of redundancy with Origins, but the further descriptions show that the SEU and Origins areas do not really overlap. Dr. Kolb noted that the SEUS concern was primarily in Origins RFA 1. The changes in the wording of the Origins roadmap that were noted by Dr. Dressler should clear up the problem. The RFA's can be worded in such a way that there are clear approaches. Dr. Dressler indicated that there should be a revised draft in a couple of weeks that Dr. Phinney and Dr. Kolb could review.

Mission Updates

Gravity Probe B

Dr. Jeff Kolodziejczak, Project Scientist, briefed the SEUS on the status of GP-B mission. MSFC manages the project, which is led by Stanford University. Lockheed Martin is the prime contractor under contract to Stanford. Dr. Kolodziejczak provided a brief overview of the science and summarized the mission concept. The objective of GP-B is to test two predictions of Einstein's theory of general relativity. Stanford has done an outstanding job with the performance parameters. The current launch date is April 24, 2003 on a Delta II vehicle from VAFB. The payload has been complete for about a year; all of the science requirements were met. Risks and current issues include the spinup gas management system, the vacuum shell leak repair, and a signal drift in SQUID #1. Currently, the project is preparing to perform the vacuum shell leak repair before repeating the functional tests in preparation for the space vehicle acoustic test. Net loss to schedule is about three weeks. Some of the open issues with operations involve the gyro suspension system. Four mission simulations have been completed. Dr. Kolodziejczak provided an overview of the data analysis. The Level 1 preprocessors and Level 2 analysis algorithms are complete for the main science data. Verification of the algorithms has been achieved by running end-to-end tests. The project is managing risks in several areas. At present, the launch date is not in jeopardy, but schedule reserve is diminishing.

Swift Gamma Ray Burst Explorer (Swift)

Dr. Neil Gehrels, Swift PI, briefed the SEUS on the Swift mission. It is about 1 year from launch (September 2003). Swift is an international mission with two of the main instruments coming from the U.K. and Italy. GSFC is the lead center; the university partner is Pennsylvania State; the spacecraft partner is Spectrum Astro. Dr. Gehrels described the three instruments on Swift: the Burst Area Telescope (BAT),

the X-Ray Telescope, and the UV/Optical Telescope. The latter two have been completed. The BAT (being built at GSFC) is on schedule for delivery. Dr. Gehrels discussed the capabilities of Swift for gamma ray bursts and non-gamma ray bursts. The Swift data dissemination policy is rapid dissemination of burst positions and data to the world community via GCN and WWW. There will be archive sites in the US, Italy, and the U.K. A GI program has been approved for Swift, and it will be announced through the ROSS-03 NRA in January 2003. Several workshops have been planned to educate the community about the mission, and an E/PO program is in high gear.

Meeting Wrap Up

Dr. Hertz invited suggestions for agenda items for the next meeting. He noted that this was Dr. Lester's last meeting. Within the next six months, four additional SEUS members will be rotating off of the Subcommittee. He requested names of potential candidates to serve on the SEUS.

Dr. Phinney showed the revised Beyond Einstein objectives (3) and RFA's (7) and the Cycles objectives (2) and RFA's (7).

Dr. Kolb invited final comments from the SEUS members.

Dr. Wright stated that he looked forward to seeing the launch of GP-B. Dr. Swordy remarked that the roadmap looks good, but we must try to understand the balance of SMEX and MIDEX. We should understand the potential of ULDB. Dr. White expressed concern about the cost caps and the "squeezing" of the MO&DA phase of Explorer missions. Dr. Lester noted that the issue over what is Origins and what is SEU will come up again. Dr. Peterson expressed a couple of concerns. It is important to look at the balance among the small programs and make some recommendations on what might be some appropriate caps and the balance in the program. In the roadmap, some of the things that are described may not be the best way to do the science. We should be careful about saying what we want to do and how we want to do it. Dr. Hewitt noted the issue of cost capped programs being squeezed by the cost of launch vehicles. Dr. Hertz indicated that the cost caps are completely within OSS control; however, the consequence of a higher cost cap is a lower launch rate. Dr. Heckman expressed some concern about the science that may be "orphaned" in the current roadmaps. Dr. Flanagan asked for a copy of the ULDB product the Dr. Jones and Dr. Swordy will be developing. She noted that she had an action item regarding looking into the best way to distribute it to the community. Dr. Dermer expressed concern over the proper resolution of SAFIR and where it belongs. Also, formation of structure from cold dark matter was left out of the roadmap. Dr. Bregman commented that he was very pleased with the roadmap, and there should be fanfare in rolling it out. Dr. Kolb thanked the Roadmap Team for all of their efforts, as well as the SEUS for their participation.

The meeting was adjourned at 3:00.

AGENDA

Structure and Evolution of the Universe Subcommittee (SEUS)

August 8-9, 2002

NASA Headquarters

Room 9H40 (PRC)

Thursday 8 August

8:30–8:45	R. Kolb	Call to Order and Organizational Issues
8:45–9:15	P. Hertz	SEU Theme Update
9:15–10:00	A. Kinney	Astronomy & Physics Report
10:00–10:15	R. Kolb	Report from the August SScAC meeting
10:15–10:30	W. Freedman	CAA report
10:30–10:45		<i>Break</i>
10:45–11:30	S. Smith	Ultra-Long Duration Balloon Program
11:00–12:00	J. Bregman	Report of the SAWG
12:00–12:15	J. Hayes	Report on Senior Review
12:15–1:30		<i>Lunch</i>
1:30–3:30	S. Phinney	Roadmap Report and Discussions
3:30–3:45		<i>Break</i>
3:45–5:15	All	Roadmap discussions
5:15–5:30	R. Kolb	Planning for Following Day
7:00		Committee dinner at a restaurant TBD

Friday 9 August

8:30–9:00	R. Kolb	Call to Order and Organizational Issues
9:00–9:30	K. Flanagan	Report of the APWG
9:30–9:45	R. Maizel	Initiative Strategies & Funding Lines
9:45–10:15	H. Thronson	NASA Exploration Team (NEXT)
10:15–10:30		<i>Break</i>
10:30–12:00	All	Roadmap discussions
12:00–1:00		<i>Lunch</i>
12:30–1:00	A. Dressler	Lunch Discussion: Update on Origins
		Roadmap (via telecon)
1:00–2:30		Mission Updates
	J. Kolodziejczak	Gravity Probe B (GPB)
	N. Gehrels	Swift Gamma Ray Burst Explorer (Swift)
2:30–3:00	All	Discussion of Issues to Raise with Kinney
3:00–3:15		<i>Break</i>
3:15–4:00	All	Close-out with Kinney
4:00–4:15	R. Kolb	Planning for Future Meetings
4:15–4:30	All	Final discussion
4:30		<i>Adjourn</i>

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STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

August 8-9, 2002

NASA Headquarters

Washington, DC

MEETING ATTENDEES

Subcommittee Members:

Kolb, Edward "Rocky" (*Chair*)
Bregman, Joel
Dermer, Charles
Flanagan, Kathryn
Heckman, Timothy
Hertz, Paul (*Executive Secretary*)
Hewitt, Jacqueline
Lester, Daniel
Peterson, Bradley
Phinney, E. Sterl
Swordy, Simon
White, Nicholas
Wright, Edward
Yorke, Harold

CERN
University of Michigan
Naval Research Laboratory
Massachusetts Institute of Technology
Johns Hopkins University
NASA Headquarters
Massachusetts Institute of Technology
University of Texas
The Ohio State University
California Institute of Technology
University of Chicago
NASA/GSFC
University of California, Los Angeles
NASA/JPL

NASA Attendees:

Allen, Marc	NASA Headquarters
Beasley, Dolores	NASA Headquarters
DeMinco, Paul	NASA/GSFC
Gehrels, Neil	NASA/GSFC
Hasan, Hashima	NASA Headquarters
Horowitz, Steve	NASA Headquarters
Jones, W. Vernon	NASA Headquarters
Kaluzienski, Lou	NASA Headquarters
Kinney, Anne	NASA Headquarters
Kolodziejczak, Jeff	NASA/MSFC
Maizel, Roy	NASA Headquarters
Martin, Gary	NASA Headquarters
Moore, Mike	NASA Headquarters
Niebor, Susan	NASA Headquarters
Sabinit, Phil	NASA Headquarters
Salamon, Michael	NASA Headquarters
Schwartz, Chris	NASA/GSFC
Smith, J. Steve	NASA/GSFC
Teplitz, V. C.	NASA/GSFC
Thronson, Harley	NASA Headquarters

Other Attendees:

Bauer, Dave	TRW
Beres, Kathleen	Orbital
Church, Sarah	Stanford University
Conte, Dom	Spectrum Astro
Davies, Donald	TRW

DiBiasti, Lamont
Freedman, Wendy
Herman, Dan
Hogan, Craig
Kahn, Steven
Malay, Jon
Purcell, William
Taylor, David
Turner, Kathy

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Carnegie Observatories
Brashear LP
University of Washington
Columbia University
Ball Aerospace
Ball Aerospace
Lockheed Martin/CSOC
DOE

STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

August 8-9, 2002

NASA Headquarters

Washington, DC

RECOMMENDATIONS

[insert letter from Dr. Kolb to Dr. Kinney here]

STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

WORKING GROUP REPORTS

Report of the Science Archive Working Group (SAWG)

The inaugural meeting of the Science Archive Working Group (SAWG) met at NASA Headquarters on April 29-30, 2002 and was attended by the members Julian Borrill, Roger Brissenden, Joel Bregman (Chair), Damien Christian, Eric Feigelson, Menas Kafatos, William Oegerle (Co-Chair), Sally Oey, Tom McGlynn, and Richard White, along with Paul Hertz and Joe Brederkamp from NASA HQ (absent were Jonathan Borden and Carol Lonsdale). There were a variety of presentations by some, but not all of the archive centers and related programs that report or receive support under the SEUS and Origins themes. We report on the discussions surrounding the presentations where there were substantive issues under consideration.

National Virtual Observatory

There were three presentations on the National Virtual Observatory (NVO), by Alex Szalay, Bob Hanisch, and George Djorgovski, which covered the general technical capabilities of such a system as well as its scientific benefits; the recently funded NSF/ITR activities were presented in detail. Also, four of the existing NASA data centers (HEASARC, Nick White; MAST, Marc Postman; IRSA, George Helou; ADC, Jim Green) reported upon their organizations and outlined their activities that relate to the NVO. The NVO concept is becoming defined and the SAWG was impressed with both the thoughtfulness of the program and with the degree of cooperation between the NVO lead personnel, the various data centers and the people in both universities and in industry. The NVO group is aware of the international efforts and hope to coordinate activities when feasible. The NVO is the natural evolution of the activities that have been occurring at the archival data centers and it is a feasible project that should have benefit well beyond the borders of the SEUS and OS themes in NASA. It will greatly enhance the usefulness and value of astronomical archival data, which we regard as a national treasure.

The NVO is built around the data archives, whose vitality is essential to this endeavor. The NASA astrophysics data centers have a strong record and have developed a coordinating council (the ADEC) to help define cooperative ventures and to avoid duplication of effort. It, along with the individual data centers, contributes to NVO activities. In contrast, there are no optical and radio ground based archives at this time, a regrettable shortcoming that we hope will be rectified within the next few years. Archives from ground-based data will be an essential component of the NVO.

While we support the NVO concept, there remains a great deal to be defined. In particular, a formal proposal and work plan to NASA needs to be developed before NASA and the SAWG can comment upon the detailed issues of schedule and budget. In general terms, aside from suggested new research funds, the incremental cost for NASA to develop its part of the NVO may be relatively modest and should be significantly less than would be required from the NSF, due to the cost of developing ground-based archives. Regarding the research component, should the NVO greatly enrich archival data analysis, research funding should become commensurate with the change in scientific activity.

The NSF ITR program is helping to develop pieces that will contribute to the NVO and we view this as a testbed that will lead to a more complete system in the future. The NVO team has shown great care in the management of the project, which will be essential to its success. We look forward to the initial demonstration projects that will be presented in January 2003 at the AAS meeting.

National Herschel Science Center

George Helou presented the IPAC plans for supporting US-based investigators of the Herschel mission. The placement of the National Herschel Science Center at IPAC makes optimal use of existing expertise, places the science support center nearly to US science instrument builders, and will ensure that software systems and archives are based on existing successful systems. The SAWG endorses the decision to locate the National Herschel Science Center at IPAC.

The labor levels for developing the science center were provided and the SAWG had some concern. The labor level was expected to be 38 FTEs during the prime phase of Herschel at the HEASARC

during their prime phases. There was insufficient information available to properly review the required level so we recommend that a clear definition of the requirements and software deliverables for supporting the US community be developed and used to justify the staffing levels proposed.

We also note the reliance on the European component of the program and suggest that once the requirements have been baselined, a set of dependencies be identified and an appropriate agreement with the Europeans be developed.

CMB Data Center

Gary Hinshaw presented a proposal to create a Cosmic Microwave Background (CMB) data center by consolidating the Active Archive for the MAP mission with the COBE and SWAS archives within the Laboratory for Astronomy and Solar Physics (Code 680; as there were few details, this was more of a “concept” than a “proposal”). The proposal creates a thematic data center with expert support for the community and consolidates resources to maximize the science expertise and output product quality. We note that the GSFC Space Science Directorate (Code 600) Visiting Committee recommended in April 2002 that the MAP Active Archive be consolidated in this way. Also, the pre-launch agreement is to house the MAP data in the ADC Active Archive. We note that NSSDC Astrophysics encompasses three components: the Permanent Archive; the Active Archive, and the ADC. The proposal for a CMB archive applies to the Active Archive and does not affect the contents of the Permanent Archive. It is possible that resources from the ADC may be redirected to partly fund a CMB archive and this must be balanced against the value of the ADC activities that would be reduced or eliminated.

The resources required to operate the CMB data center were estimated at ~4 FTE, which is approximately double the existing level of personnel. At the present level, the data from MAP are ingested and available to the community, but with little or no support in the areas of dealing with questions from users or providing expert commentary. The SAWG concurs that these data sets should receive proper curation and that there will be significant value added to both the science and community. During the period in which MAP data is the main archive data set, the nature of this archive might be quite different from other data archives. In other imaging archives, there are typically many objects per field, so a variety of users download the same data for many different purposes. From this model, we have an understanding of the necessary staffing levels. The MAP data set is entirely different, so the usual staffing model may not apply. The MAP data is likely to be used by a few expert users, such as the teams involved in other CMB experiments or those dealing with foreground and background issues in this waveband. As the staffing levels were not particularly well justified, this issue may need to be revisited on a yearly basis.

The issue of location of a CMB archive was not discussed, as it was assumed to reside at GSFC and it is sensible to have the expertise and the data at the same location. However, the IRSA will be the home for Planck, the next large CMB mission after MAP (and other far-IR missions will reside at the IRSA). If a CMB archive at GSFC has no additional mission after MAP for a substantial number of years, it may not be a viable long-term archive. Prior to the formation or enhancement of a CMB archive, NASA should consider how the long-term needs of the community would best be served.

The concept was put forward that the CMB data center might incorporate data sets from sub-orbital missions. This is likely to be a useful addition but it places new demands on those missions, which would require additional funding. The addition of funding to permit archiving of sub-orbital mission data might reduce the total number of such missions, so the CMB community should be queried as to whether this is a sensible trade-off.

ADC Activities

One of the most difficult issues that the SAWG faced was in assessing the vitality and importance of the activities being carried out by the ADC. They conduct such activities as: accumulation of tables; ability to search for table (ADC Data Viewer); plotting of different columns of data tables (CatsEye), a graphical interface to astronomical databases (IMPreSS), development of XML tools, a method to query catalog holdings (AMASE), some EPO activities; and they are a mirror for Vizier service, which come from the CDS in Strasbourg. This was the lowest rated of the archive sites in the last Senior Review, although the absolute rating still indicates that the Senior Review believed it to be of value. The level required to continue all these activities is about \$500k/yr but a decision was made within Code 600 (the Space Science Operations Data Office) to reduce the funding level to the ADC by about half. It has been

difficult to understand the tasks of ADC staff members prior to and after staff reductions, so we cannot effectively on the proper number of FTEs to conduct various tasks. The following concentrates on the functions of the ADC rather than on staffing levels.

The primary activity of the ADC centers on their tables and since the CDS also ingests tables, the issue of duplication of effort is central to the discussion. This issue was not adequately developed in the presentation by Jim Green, although he responded to further inquiries by email, which were very helpful. According to his response, on an annual basis, the ADC ingests about 1/3 of all astronomical catalogs. It has been difficult to confirm this although we requested and were sent a list of the tables ingested in 2001. During 2001, the ADC ingested 33 tables (or table sets from papers), while the CDS ingested about 50 per month, nearly 20 times more (only 1 table in the month of April 2002 is acknowledged to come from NASA/GSFC). Even for a reduced staff size, this seems like a low rate of table ingestion and inconsistent with the presentation and email of Jim Green.

The ADC has developed an SGML-to-XML ingest pipeline and they provide quality control to this process, sometimes finding error in table entries. Their Data Viewer is very capable and in some ways superior to VisieR, its competitor. Usage of this site has been less than at the other archive sites, although usage has increased in the past few months and by improving the connections to these tables (e.g., from the IRSA), this may become a heavily used site. However, some features offered by the ADC are not broadly used by the community, and given the alternatives, are not likely to become widely used by the community. One example is their graphical interface to databases (IMPreSS), since there are other viewers that are quite capable and are more widely used (e.g., SkyView). Most of these tools probably do not have the correct architecture to be incorporated into the NVO activities, although this was not discussed either. There is a general issue of too many graphical viewers, each of which have been developed at the various archive sites, and this is something that the ADEC should deal with.

Regarding their XML development work, the ADC were pioneers in this area. With relationship to the NVO project, there is a contract from the NSF-funded program to ADC/Raytheon for 1/2 FTE in 2002, 1 FTE in 2003, and 1/2 FTE in 2004, according to Bob Hanisch. This is primarily for support of Ed Shaya, who is valuable to the NVO program. However, the NVO project is not dependent upon the ADC for XML development. If funding is available, support for XML development is certainly useful, but this should not be traded against funding that would go forward to ingesting tabular data.

It is probably important to have one US site that is involved in the ingestion and query of tabular data. This would naturally connect to the efforts by publishers of journals in North America (such as ApJ), who have been involved in connecting many parts of articles with databases. Currently, the ApJ provides ASCII versions of all tables since the advent of electronic on-line articles (a really inexpensive way of augmenting the archive is to make a simple ASCII file of name of tables and the volume that they come from, since they are easy to download). Also, if we rely entirely on foreign institutions, we will have little input or control on the process and the needs of the NASA community may not be adequately served, with little recourse. Having more than one institution involved in tabular data activities is likely to lead to competition, which will help to improve efficiency and quality of offerings (competition between some of the other data centers has been quite important). Also, links to these tables from the other data centers need to be improved. One might consider whether such table activities should continue within the ADC or moved elsewhere.

Finally, some members of the SAWG were surprised that NASA pays the CDS a substantial yearly fee. As all NASA archival sites are free to users worldwide, NASA should reconsider their current agreement.

Other Items of Note

We are relieved to see that a significant amount of data has finally arrived in the XMM archives, although the situation is still not ideal. The interface to the archive does not work on a variety of machines and there is a limit as to the number of data sets that a site can download per week. Also, it would be helpful if there were a mirror site in the US rather than being required to download from the site in Spain, where the bandwidth is much more limited.

The reports by the other presenters were in line with expectations and the committee did not have particular concerns.

Report of the Astronomy and Physics Working Group (APWG)

The Astronomy & Physics Working Group met on April 25 & 26 at NASA Headquarters. Members who were present were Chris Blades, Ed Cheng, Mark Devlin, Brenda Dingus, Kathryn Flanagan (Co-Chair), Terry Herter, Dick Miller, Doug Richstone (Chair), Wilt Sanders, Eun Suk Seo, Ted Snow and Erick Young. The meeting agenda is attached. The committee is impressed with the scope, vitality and impact of the R&A and SR&T programs. As usual, this report focuses on the few issues where we were asked to comment on specific questions, or wished to bring certain issues to your attention.

Merging the SR&T and R&A Programs into two large reviews.

The APWG was shown a top-level plan to merge several of the elements of the ROSS announcement and subsequent review processes for the SARA, HEA, Theory/DA and Origins programs. One purpose of the change is to implement a desire by the SScAC to have a broad peer-review evaluation of the SR&T program that allows funds to cross the traditional (historical) discipline lines. The APWG agrees with this purpose. However, it is important that investigators in the affected disciplines be notified of any changes in advance so that they can appropriately prepare their proposals. We recommend that the flexibility be maintained for proposers to combine appropriate elements into a single proposal, e.g., to include detector development or laboratory astrophysics components in a proposal that is primarily sub-orbital. The APWG also recommends that any reallocation of funds should be limited to a modest level from year to year. This will allow the potential flow of funds across discipline lines to occur in a smooth fashion giving proposers adequate time to adjust to the changes.

The practical implementation of this combined program is a concern of the APWG. The resulting review will be very large and difficult to carry out efficiently. In addition, the wide range of technical and scientific specialties involved will make it difficult to convene a panel with the breadth and interest to capably review the mix of proposals. One possible procedure would be to do the reviews within a few weeks of each other, followed by a meeting between the panel chairs and the discipline scientists to intercompare the quality of the proposals.

The issues noted above apply primarily to the APSR&TRA part of the program. The APWG was less concerned about the impact of the unification on the APRA program.

The APWG would like a report on the progress of this activity.

Technology Development

The APWG is encouraged by the progress that has been made in organizing diverse technology development efforts to support future missions. Key challenges will be to clearly define the technology requirements, communicate them to the technology management organizations, select the best technology implementers, and the overall accountability of the technology program. The APWG is particularly impressed that roughly half of the Code R technology development funds is currently "peer reviewed." The fraction of "openly competed" funding should be increased as rapidly and to the maximum extent practical. Code S participation in defining these opportunities as well as in the peer review will help ensure that proven processes and procedures will be used. We anticipate further discussion of this at our next meeting.

Science using balloon-borne payloads

The APWG is happy to learn of the FY03 augmentation to the balloon program to stabilize the program for traditional and LDB operations. In addition to its proven capabilities to deliver world-class science, the balloon program continues to provide a unique development platform for testing new technologies, and more importantly, provides critical hand-on training for future generations of scientists and engineers for space missions. Continuing these contributions is critical to successfully fulfilling many aspects of NASA's mission.

The APWG is also happy to learn that a balloon mission fared well in the most recent round of MIDEX selections. The future success of such missions is critical to enabling and sustaining the ULDB capabilities currently in development. The ULDB program holds great promise for further improving the already remarkable cost/benefit metric of NASA's existing balloon technology.

The distribution of grant funds for programs with investigators at different institutions

When a funded research program involves investigators from multiple institutions, NASA has in some cases issued a single grant to the PI institution, requiring that funds for Co-I's be distributed through subcontracts. In other instances NASA has issued individual grants separately to the PI and Co-I institutions. In the first case some of the grant money is subject to "double overhead" because a portion of the grant is subject to indirect cost charges at both the PI and Co-I institutions. This problem is often most acute for small grants, because many institutions charge their standard overhead rate on the first \$10,000 of \$20,000 of a subcontract. The situation is not exactly the same at all institutions. The APWG encourages NASA to offer the option of individual grants to Co-I institutions in collaborative programs, in order to maximize the effectiveness of the grants. Questions of PI control over the research can be addressed through the budgeting and reporting process, as has been demonstrated by the High Energy Astrophysics discipline office, which routinely issues separate grants to Co-I institutions.

On the web site supporting ROSS:

The APWG supports the increased use of web-based services for proposers. It is important that these web services be navigable and effective. We are concerned that the web site for the ROSS 2002 proposal opportunity is very complex and confusing, sometimes obscuring the pathways to needed information. It appears to be worse than the previous version. We urge NASA to conduct a review of this web site in preparation for ROSS 2003, perhaps involving representatives of the user community to help test, simplify, and debug the site.

Funding for NVO activities

We were briefed about the issue of where to find funds for the National Virtual Observatory, a high priority recommendation of the National Academy Decadal Report. We believe that the Decadal Report panel did not intend to fund the NVO effort at the expense of ongoing NASA R&A activities, but was seeking new funding for this activity. APWG supports the use of archives (and believes that the large NASA missions have recently done a good job of archiving data and of making those archives usable by the scientific community). However, we think that the diversion of resources from R&A to support NVO would be extremely damaging to current and future astronomical activities supported by NASA.

The recent ATP review

We were briefed about the difficulties in identifying reviewers for the preceding ATP review. In response to questions raised during the discussion, the APWG feels that panel size is probably optimal at about 6 members, that the number of panels could be reduced through judicious combinations of activities to review. The issue of conflicts of interest in these reviews was differentiated according to the kind of conflicts. Institutional conflicts were not seen as overly serious, since, at least for universities there is not a great incentive to help colleagues. On the other hand, having PIs present at a review, even on another panel was seen as highly undesirable. The APWG believes that the use of panel chairs in balancing the review across the panel usually works well.

Close out funding

The APWG recognizes the importance of the long term investment in established efforts. In those areas where the abrupt termination of a program will lead to the immediate, irretrievable loss of a critical capability, the APWG recommends that those programs be considered for one year reduced "bridge" funding. This funding is intended to allow the groups to re-apply for funding with the hope of preserving

this capability. Such funding should be at the discretion of the discipline scientists balancing the cost of the loss of the capability with the potential gain of funding a new initiative or new investigators.

We suspect that the balance between maintaining specific capabilities and encouraging new investigations is somewhat more favorable to the former in the technology areas, and somewhat more favorable to the latter in the more theoretical areas.

The roadmap process

APWG heard reports on the progress of the SEU and Origins Subcommittees in constructing their roadmaps for the OSS Strategic Plan. The SEUS has asked the APWG for help with the R&A part of their plan. APWG has appointed a subcommittee to respond to those issues composed of Kathy Flanagan (Chair), Chris Blades, Ed Cheng, Brenda Dingus, Wilt Sanders, Ted Snow and Tuck Stebbins.

Laboratory Astrophysics

The APWG had a brief discussion of Laboratory Astrophysics issues. There are some concerns in the community that Lab Astrophysics activities of great value for the interpretation of data from current and future NASA missions may be losing support because they do not align well with the current structure of the R&A or SR&T programs. There are two workshops on NASA supported Lab Astrophysics in the very near future. Ted Snow will attend one of these and will report back to APWG on this issue.

Coordination with NSF

The APWG heard a report on the progress of the response to the COMRAA Report. While much remains to be sorted out, we note that the coordination of NASA and NSF activities is of considerable importance. We do not understand how the NSF/NASA committee will interact or exchange information with the NASA advisory structure (the FACA committees and the WGs) already in place.

STRUCTURE AND EVOLUTION OF THE UNIVERSE SUBCOMMITTEE (SEUS)

August 8-9, 2002

Washington, DC

LIST OF PRESENTATION MATERIAL¹

- 1) SEU Theme Update [Hertz]
- 2) Astronomy & Physics Report [Kinney]
- 3) Highlights from the August SScAC Meeting [Kolb]
- 4) CAA Report [Freedman]
- 5) Ultra-Long Duration Balloon Program [Smith]
- 6) Science Archive Working Group Report [Bregman]
- 7) Report on Senior Review [Hayes]
- 8) APWG Report [Flanagan]
- 9) Fiscal Year 2003 Estimates [Maizel]
- 10) NASA Exploration Team [Thronson]
- 11) Gravity Probe B [Kolodziejczak]
- 12) Swift Gamma Ray Burst Explorer [Gehrels]

Other material distributed at the meeting:

- 1) Theme Roadmap Document Guidance

¹ Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, DC 20546.